SECTION 3

Remedial Alternatives

This section presents the remedial alternatives developed for this FFS. The remedial alternatives were developed for each Inboard Area site that requires further action. These Inboard Area sites include sites where COCs were identified. The following remedial alternatives were developed by assembling remedial technologies compatible with a wetland end-use scenario into treatment options that address COCs and meet RAOs:

- Alternative 1 – No Further Action
- Alternative 2 – Institutional Controls
- Alternative 3 – Excavation with Offsite Disposal
- Alternative 4 – Excavation with Onsite Disposal

These remedial alternatives emphasize, to the extent practicable, the application of proven treatment technologies which are capable of restoring affected media to a degree compatible with future wetland reuse. Below is a detailed description of each remedial alternative.

3.1 Alternative 1 – No Further Action

In accordance with the National Contingency Plan (NCP) (40 Code of Federal Regulation [CFR] 300) and CERCLA guidance (EPA, 1988a), a No Further Action alternative was developed for evaluation at each site. The No Further Action alternative reflects current site conditions and provides a baseline against which the other alternatives are evaluated. This alternative allows the incremental value of other alternatives to be evaluated. In the case of HAAF, soil removal actions have made considerable progress toward cleanup. These actions are considered part of the No Further Action alternative.

This alternative would include maintaining the property and providing controls for a prescribed time frame (if necessary) to prevent access to the area. It would include maintaining and operating the PDD pump station and drainage system and monitoring the levees until the wetlands restoration is initiated.

3.2 Alternative 2 – Institutional Controls

The goal of this alternative is to protect human health and the environment by eliminating the exposure pathway between residual contaminants of concern and future wetland receptors. Institutional controls are non-engineering, legal measures that limit exposure to hazardous substances by restricting land and/or water use. Institutional controls are generally implemented in one of two ways. *Governmental controls* are implemented through state or local authorities and restrict property use. Examples include zoning restrictions and permit requirements for well drilling. *Proprietary controls* are placed in the chain of title to real property for the purpose of imposing restrictions on land or water use. Proprietary controls take the form of easements, covenants, restrictions, and servitudes. Proprietary controls include provisions that they "run with the land" (i.e., they are binding on subsequent property owners). Examples of proprietary controls used to support environmental remediation may include reservations of rights for access and requirements to receive permission from the U.S. Army or regulatory agencies before making significant changes in land use.

For the Inboard Area sites, the U.S. Army would establish institutional controls using both proprietary and governmental controls. These controls would be applied to areas where, under a wetland scenario, residual soil contamination is present at concentrations that could pose a potential risk to human health or the environment. The controls would protect receptors within the wetland environment by preventing receptor exposure to residual contamination above comparator values once the wetland is constructed.

The institutional controls would establish performance criteria requiring the final design for the wetland construction to provide for the placement and monitoring of cover material in specified areas and/or restrict excavation and erosion in specified areas. Cover may consist of dredge material and/or borrow material from onsite. Specified areas are shown in Figures B-1 through B-17 in Appendix B.

Based on fate and transport studies (see Appendix E) and consensus of the regulators and resources trustees, the performance criteria would specify that the final wetland design must provide for three feet of stable cover material during the development and maturation of the wetland over areas that have residual contamination at levels above comparator values. The mathematical model presented in the fate and transport study determined that one (1) foot of cover would be a sufficient barrier to prevent exposure of receptors to residual contamination that might migrate by diffusion in groundwater. The model used the following assumptions: diffusion is the dominant transport mechanism, the sources of contamination are constant in time, and there is no degradation of contaminants in transit. While one foot of cover could protect against diffusion migration, discussions between the U.S. Army and the regulators and resources trustees concluded that a total of three (3) feet of stable cover should be provided to protect receptors whose habitat or feeding ranges include subsurface sediment or soil.

The regulators and resources trustees agreed that a stable depth of 3 feet of cover would be sufficient to ensure that there will be no exposure to future wetland receptors. The performance criteria would also specify that the stable presence of cover must be adequately monitored and that excavation and erosion of cover would be prohibited throughout the development and maturation of the wetland.

If the performance criteria for the stable depth of three feet of cover can not be met by the final wetland design, then excavation and offsite disposal as described in Alternative 3 would be required. The final wetland design would be prepared by the USACE, San Francisco District. The U.S. Army would ensure that the final wetland design and the grading plans for the final wetland design meet the specified performance criteria and are protective of the future wetland receptors. Through a formal process, the regulator agencies would review the final wetland design and grading plan.

As part of the wetland restoration project, the wetland design team (in consultation with the U.S. Army) would develop a comprehensive wetland project monitoring program. This program would monitor both the natural development of the wetland system and the longterm compliance with the performance criteria specified for placement of cover and/or prevention of erosion and excavation.

The details of the monitoring plan (such as monitoring frequency, specific monitoring activities, and monitoring locations) will be developed in conjunction with the final wetland design to ensure maximum effectiveness of the monitoring program. The plan will consider activities such as chemical, physical and/or biological monitoring. The types of monitoring activities that will be considered in the monitoring plan include:

- Measurements to determine subtle changes in topography including: pin studies, visual observation, and/or aerial topographic surveys.
- Monitoring of sediment and water quality at several locations within the wetland project.
- Monitoring of flora and fauna for contaminant uptake.

The objective of monitoring will be to ensure that the performance criteria specified in this alternative are met during the development and maturation of the wetland. The goals of the monitoring will be to verify the physical barrier is present and to distinguish between the presence and potential effects of residual contaminants onsite from the presence and potential effects of contaminants that may be brought onsite as part of the wetland restoration project or natural processes. Once a site is physically mature (stable), the determination as to whether monitoring should be continued will be made on a site by site basis.

An final wetland design plan would be prepared describing the specific activity that will be conducted. The plan will include a map showing features of the final wetland design overlying areas that require institutional controls. The map will specifically show where cover material and/or prohibition of excavation and erosion would be required.

The authorizing legislation for the Hamilton Wetland Restoration Project (Water Resources Development Act of 1999) requires the preparation of an Adaptive Management Plan. The purpose of this plan is primarily to address actions that could be taken to preserve habitat values and resources in the event that the wetland does not develop and mature as planned. The Adaptive Management Plan will also address actions that could be taken if the performance criteria specified in the ROD/RAP are not met during the development and maturation of the wetland. The Adaptive Management Plan will be prepared by the Army Corps of Engineers San Francisco District following completion of the final wetland design.

3.3 Alternative 3 – Excavation and Offsite Disposal

Under this alternative, areas where remedial action is proposed (COCs are greater than chemical-specific RAOs and sufficient stable cover is not practical) would require removal through excavation. Confirmation samples would be collected to verify RAOs are met. These samples could be collected as pre-design investigation borings that would be drilled prior to excavation to determine the extent of the excavation geometry. Alternatively, confirmation samples could be collected following excavation activities from the bottom and sidewalls of the excavation. Contaminated material would be excavated using standard construction equipment. Excavation would continue until RAOs were achieved to ensure protection of human health and the environment. The excavated area would be backfilled with certified clean fill as necessary and recontoured to eliminate topographic depressions.

Institutional controls in the form of land-use restrictions are not required because contamination does not remain above levels considered acceptable for a wetlands end use.

This alternative would require any contaminated soils removed to be shipped offsite. It would require disposal in an approved landfill or treatment at a recycling facility. Landfill disposal sites for nonhazardous and hazardous wastes are located throughout the United States. This remedial technology is generally accepted and is commonly used in industry. Offsite disposal costs are dependent on the distance to the disposal facility and the classification of the waste; therefore, waste profiling would be required. A few waste recycling facilities exist where the contaminated soils could be treated and combined with other materials to create an asphalt base for roadways.

3.4 Alternative 4 – Excavation and Onsite Disposal

Under this alternative, areas where remedial action is required (COCs are greater than chemical-specific RAOs) and sufficient stable cover is not practical, would require removal through excavation. Prior to initiating excavation activities, pre-design investigation borings would be drilled where necessary to determine the excavation geometry. Impacted material would be excavated using standard construction equipment. Excavation would continue until RAOs are achieved to ensure protection of human health and the environment. The excavated area would be backfilled with certified clean fill as necessary and recontoured to eliminate topographic depressions.

Institutional controls in the form of land-use restrictions are not required because contamination does not remain above levels considered unacceptable for a wetlands end-use. The excavated soils would be transported to an onsite consolidation/disposal area located in the general vicinity of the seasonal wetlands.

The consolidation site would require conformance to the substantive requirements of the RWQCB regulations. It is assumed that the excavated material would be considered a designated waste and would require Class II management; the waste would be characterized before determining the type of waste management unit. The consolidation site would be designed as a Class II non-municipal solid waste landfill, which would require a 2-foot clay liner or a synthetic liner and a leachate collection and removal system.

Following consolidation of the site materials, the consolidation site would require closure through installation of an engineered cap. The engineered cap would consist of an upper vegetation layer, a low permeability layer, and a foundation layer. The vegetative layer would consist of a clean top soil seeded with native grasses. This layer prevents contact with the consolidated materials, minimizes the impact of cracking and weathering, and provides a zone of evapotranspiration for precipitation. The low permeability layer typically consists of fine-grained soils such as low permeability clays (possibly Bay Mud) and would provide a more “impenetrable” barrier to infiltration as compared to overburden soils. Synthetic materials could also be used as a barrier or in conjunction with other natural materials to provide increased protection against infiltration. The foundation layer would consist of reworked and compacted existing consolidated soils. Details regarding the actual design of the engineered cap would be finalized during the remedial design phase.

The cover serves three purposes, as follows:

- To prevent contact with the consolidated material (i.e., cover acts as a barrier)
- To provide protection from wind and rain erosion
- To provide a zone of evapotranspiration to reduce precipitation infiltration

Passive gas vent wells would be included with the engineered cap to relieve gases which may otherwise build up beneath the engineered cap and to abate potential lateral migration of gases.

An engineered cap is a well-developed technology commonly used to cover waste disposal sites to prevent contact with landfill refuse and reduce precipitation infiltration. In many cases, engineered caps may be constructed of native materials. Alternately, if synthetic materials are used in the low permeability layer, specialized installation methods are necessary. The combined effects of low permeability and vegetation layers provide a highly impenetrable barrier that is weather resistant and impervious to freeze/thaw and shrink/swell cycles.

After completion of the capping activities, it would be necessary to maintain the property and provide institutional controls (e.g., fencing, security patrols) for a prescribed time frame to prevent access to the area. Additionally, post-closure maintenance would be required and would consist of cover-integrity monitoring, cover maintenance, and leachate collection and removal system maintenance.